

## Fiber optic flow measurement sensor (Rayleigh scattering)

Task Plan Element: **HYP.03.11.01.009**

Task POC: Amy (Mielke) Fagan / GRC-RHI

Task Team: Michelle Clem (GRC-RHI), Kristie Elam (GRC-FTF)

### Task Objectives

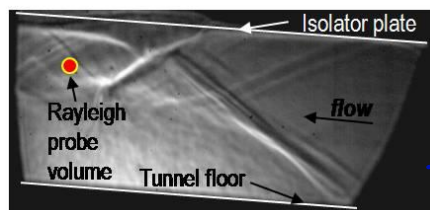
Develop a fiber optic Rayleigh scattering system capable of measuring velocity, density, and temperature in hypersonic flows; integrate in the 15x15 cm supersonic wind tunnel.

This nonintrusive molecular scattering technique will provide critical measurements for validating CFD codes in hypersonic environments where extreme temperatures & shocks are present & conventional measurement techniques are inadequate.

### Key Benefits of Rayleigh Scattering:

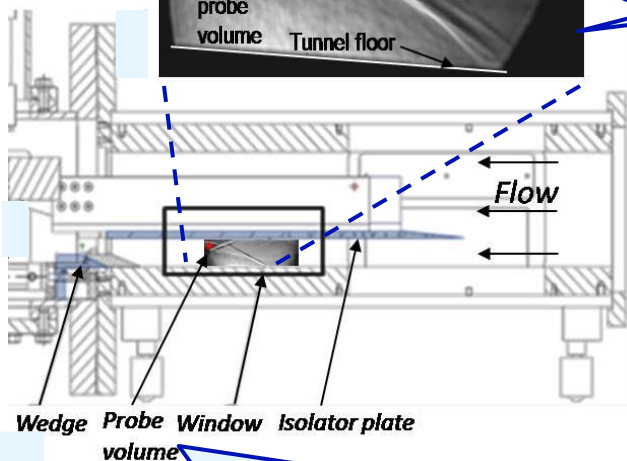
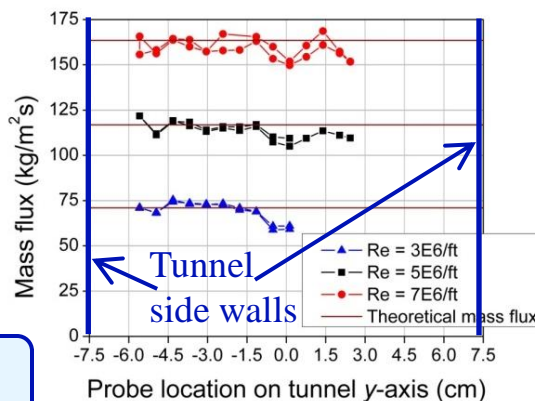
No need for particle seeding; Has the ability to measure density, temperature, and velocity simultaneously, thereby providing mass flux data; Point-wise, linear, or planar measurements are possible.

### Rayleigh Diagnostic Applied in Isolator Model in the 15x15cm Wind Tunnel



Rayleigh measurements were acquired in close proximity to strong shocks with no obvious degradation of the measurements.

### Mass flux measurements in Mach 3 flow in the 15x15 tunnel



The Rayleigh measurement probe volume was translated across the tunnel to map out the flow

**Current Status:** The technique has been demonstrated in the 15x15cm wind tunnel [ preliminary milestone HYP 03.11.01.004 ; 9-2010] . Future testing is planned in August/September 2010. We will implement changes to improve the signal-to-noise of the measurements and also map out a larger portion of the flow field. A linear measurement configuration is also planned.

**Milestone due: 9/2011**